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EXAMINER

TURNER, SAMUEL A

ART UNIT	PAPER NUMBER
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2877

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/08/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/779,864

Applicant(s)

KRIJNEN, EDWIN EDUARD
NICOLAAS JOSEPHUS

Examiner

Samuel A. Turner

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 November 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 20 is/are allowed.
- 6) ☒ Claim(s) 1-19 and 21-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 7 November 2006 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 1-24 have been considered but are moot in view of the new ground(s) of rejection.

Drawings

The corrections to the drawings dated 7 November 2006 are objected to by the Examiner. Figures 1a and 1b from the amendment above, as well as figures 2-8, are informal because they all include hand drawn numerals and legends.

Additionally, the drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the limitation "wherein said measuring laser beam and at least one additional measuring laser beam are substantially parallel and incident on said measuring mirror" found in claims 17-19 must be shown or the feature(s) canceled from the claim(s). Note that the measuring mirror is defined in claim 8. No new matter should be entered.

Replacement Drawing Sheets

Drawing changes must be made by presenting replacement sheets which incorporate the desired changes and which comply with 37 CFR 1.84. An explanation of the changes made must be presented either in the drawing amendments section, or remarks, section of the amendment paper. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). A replacement sheet must include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of the amended drawing(s) must not be labeled as "amended." If the changes to the drawing figure(s) are not accepted by the examiner, applicant will be

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notified of any required corrective action in the next Office action. No further drawing submission will be required, unless applicant is notified.

Identifying indicia, if provided, should include the title of the invention, inventor's name, and application number, or docket number (if any) if an application number has not been assigned to the application. If this information is provided, it must be placed on the front of each sheet and within the top margin.

Annotated Drawing Sheets

A marked-up copy of any amended drawing figure, including annotations indicating the changes made, may be submitted or required by the examiner. The annotated drawing sheet(s) must be clearly labeled as "Annotated Sheet" and must be presented in the amendment or remarks section that explains the change(s) to the drawings.

Timing of Corrections

Applicant is required to submit acceptable corrected drawings within the time period set in the Office action. See 37 CFR 1.85(a). Failure to take corrective action within the set period will result in ABANDONMENT of the application.

If corrected drawings are required in a Notice of Allowability (PTOL-37), the new drawings MUST be filed within the THREE MONTH shortened statutory period set for reply in the "Notice of Allowability." Extensions of time may NOT be obtained under the provisions of 37 CFR 1.136 for filing the corrected drawings after the mailing of a Notice of Allowability.

Claim Rejections - 35 USC § 112, first paragraph

The following is a quotation of the first paragraph of 35 U.S.C. § 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 18 and 19 are rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains

subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 18 requires a relatively fixed additional measuring mirror having a line normal thereto which makes a non-zero acute angle with the Z-axis, and that the additional measuring beam is incident on the additional measuring mirror in a direction substantially parallel to the line normal to the addition measuring mirror. This feature appears to be taught in figure 6(60,62) and figure 8(80,82). However, claim 17, from which claim 18 depends, requires that both measuring beams be parallel. Beams 61 and 63, in figure 6, and beams 81 and 83, figure 8, are not parallel. Claim 19 additionally requires that the different measuring mirrors be on opposite sides. The configurations do not appear to be described in the specification. Instead, claim 17 and claims 18 and 19 appear to be drawn to different embodiments.

Claim Rejections - 35 USC § 101

35 U.S.C. § 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 1-7, and 21-24 are rejected under 35 U.S.C. § 101 because the claimed invention is directed to non-statutory subject matter.

The claims are directed to a judicial exception; as such, pursuant to the Interim Guidelines on Patent Eligible Subject Matter (MPEP 2106), the claims must have either physical transformation and/or a useful, concrete and tangible result. The claims fail to include transformation from one physical state to another. Although, the claims appear useful and concrete, there does not appear to be a tangible result claimed. Merely analyzing, calculating, determining, selecting, etc. would not appear to be sufficient to constitute a tangible result, since the outcome of the analyzing, calculating, determining, selecting, etc. step has not been used in a disclosed practical application nor made available in such a manner that its usefulness in a disclosed practical application can be realized. As such, the subject matter of the claims is considered an abstract idea and is not patent eligible.

Claims 1, 7, and 21 include the limitations of "determining and processing" which does not provide a physical transformation and/or a useful, concrete and tangible result. While this step appears useful and concrete the analyzed, calculated, determined, selected, etc result is abstract because nothing is done with the result(saved, displayed, or used). Claims 2-6, and 22 are dependent on claims 1 or 21 and therefor are also included in the rejection.

Claim 23 include the limitation of determining the Z-displacement of said object which does not provide a physical transformation and/or a useful, concrete and tangible result. While this step appears useful and concrete the analyzed, calculated, determined, selected, etc result is abstract because nothing is done with

the result(saved, displayed, or used). Claim 24 is dependent on claim 23 and therefor is also included in the rejection.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 2, and 6 are rejected under 35 U.S.C. § 102(b) as being clearly anticipated by Peggs et al(CIRP-1999).

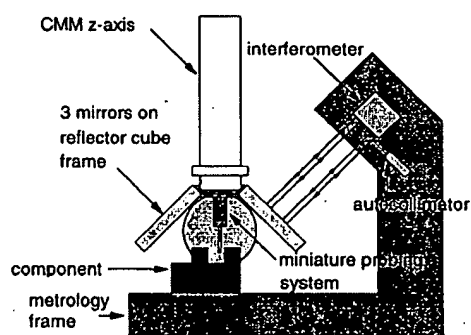


Figure 1: Schematic view of the SCMM (one axis shown)

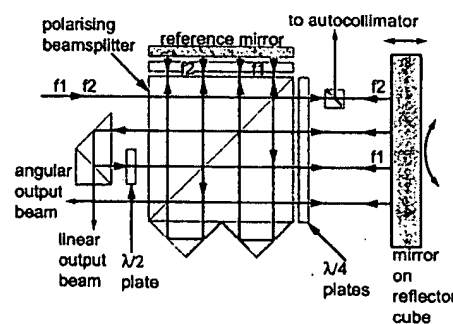


Figure 2: Optical scheme of the interferometers

With regard to claim 1, Peggs et al teach a method of determining the displacement of an object in an apparatus along the z-direction(Fig. 1):

providing a reference laser beam(Fig. 2, f1);

providing a measuring laser beam that is directed substantially perpendicularly incident on a measuring mirror with a fixed position relative to said object such that a reference line normal to the measuring mirror makes a non-zero

acute angle with said z-direction, said measuring laser beam being substantially retro-reflected and at least partly overlapping said reference beam to provide an interference signal(Fig's 1,2; the reflector cube mirror);

determining a change in said interference signal(section 2.4); and
processing said change in order to determine the displacement of said object along the z-direction(section 2.4).

The recitation that "said object being illuminated by a beam of radiation having an optical axis extending along the z-direction" has not been given patentable weight because it has been held that a preamble is denied the effect of a limitation where the claim is drawn to a structure and the portion of the claim following the preamble is a self-contained description of the structure not depending for completeness upon the introductory clause. *Kropa v. Robie*, 88 USPQ 478 (CCPA 1951).

With regard to claim 2, Peggs et al teach a method of determining the displacement of an object in an apparatus along the z-direction(Fig. 1) comprising:

providing an interferometer system comprising(Fig's 1,2):

a laser beam generator system configured to generate at least one reference laser beam and at least one measuring laser beam(Fig. 2; f1,f2);

at least one mirror, wherein said at least one mirror includes a measuring mirror with a fixed position relative to said object and having a mirror surface in which a reference line normal to the mirror surface makes a

non-zero acute angle with said z-direction(Fig's 1,2; the reflector cube mirror);

an interference signal processing system configured to receive an interference signal produced by said reference laser beam and said measuring laser beam, and to determine said displacement based on a change in said interference signal(section 2.4);

providing said reference laser beam and said measuring laser beam such that said measuring laser beam is directed towards said measuring mirror in a direction substantially perpendicular to said mirror surface and said measuring laser beam is substantially retro-reflected by said measuring mirror to at least partly overlap said reference beam to generate said interference signal(Fig.2; the linear output beam);

determining a change in said interference signal(section 2.4); and

processing said change in order to determine the displacement of said object along the z-direction(section 2.4).

The recitation that "said object having a surface which extends substantially in a plane perpendicular to said z-direction and which is illuminated by a beam of radiation having an optical axis extending along the z-direction" has not been given patentable weight because it has been held that a preamble is denied the effect of a limitation where the claim is drawn to a structure and the portion of the claim following the preamble is a self-contained description of the structure not depending

for completeness upon the introductory clause. *Kropa v. Robie*, 88 USPQ 478 (CCPA 1951).

As to claim 6/2, wherein at least one additional displacement is determined and said interference signal processing system uses said additional displacement to determining the displacement of said object in the z-direction(section 2.1).

Claim 7 is rejected under 35 U.S.C. § 102(b) as being clearly anticipated by Ukaji(6,285,457).

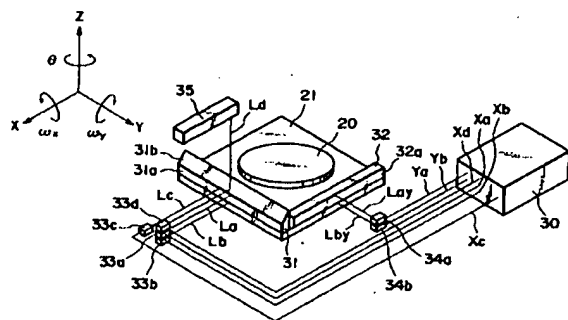


FIG. 2

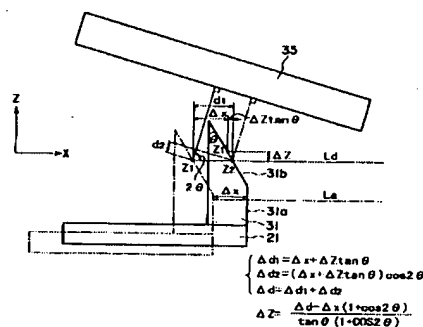


FIG. 3

With regard to claim 7, Ukaji teaches a method of determining the displacement of an object in an apparatus along the z-direction, said object having a surface which extends substantially in a plane perpendicular to said z-direction and which is illuminated by a beam of radiation having an optical axis extending along the z-direction, said method comprising(Fig's 2,3):

providing an interferometer system(column 5, lines 43-62), comprising:

a laser beam generator system arranged and constructed for generating at least one reference laser beam and at least one measuring laser beam(column 6, lines 45-57);

a set of at least two mirrors comprising at least one mirror which is a measuring mirror fixedly connected to said object and having a mirror surface in which a reference line normal to the mirror surface makes a non-zero acute angle with said z-direction(Fig. 3, 31b), and

at least one separate mirror having a fixed position with respect to said apparatus(Fig. 3, 35);

an interference signal processing system, arranged and constructed for receiving an interference signal produced by said reference beam and said measuring beam and for determining a displacement on the basis of a change in said interference signal(Fig. 2, 30);

providing a reference laser beam and a measuring laser beam, wherein said measuring laser beam is directed towards said measuring mirror such that said measuring laser beam is reflected by said measuring mirror towards said separate mirror in a direction substantially perpendicular to said separate mirror and at least partly overlaps said reference to provide an interference signal(column 6, lines 45-57);

determining a change in said interference signal(column 6, line 58- column 7, line 4); and

processing said change in said interference signal in order to determine said displacement in the z-direction(column 6, line 58- column 7, line 4).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-6, 8-15, 21, and 23 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Ukaji(6,285,457) in view of Peggs et al(CIRP-1999).

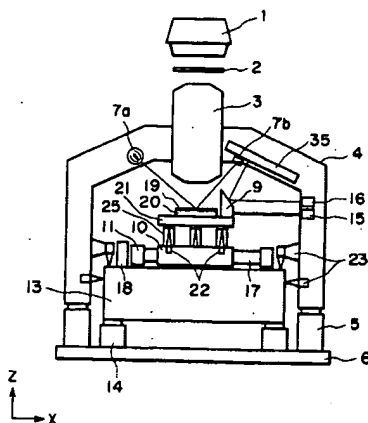


FIG. 6

With regard to claim 1, Ukaji teaches a method of determining the displacement of an object in an apparatus along the z-direction, said object being illuminated by a beam of radiation having an optical axis extending along the z-direction, said method comprising(Fig's 2,3):

providing a reference laser beam(column 6, lines 45-57);

providing a measuring laser beam that is incident on a measuring mirror with a fixed position relative to said object such that a reference line normal to the measuring mirror makes a non-zero acute angle with said z-direction, said measuring laser beam being substantially retro-reflected and at least partly overlapping said reference beam to provide an interference signal(column 6, lines 45-57);

determining a change in said interference signal(column 6, line 58- column 7, line 4); and

processing said change in order to determine the displacement of said object along the z-direction (column 6, line 58- column 7, line 4).

Ukaji uses a combination of mirrors 31b and 35 in the measurement path, and fails to teach wherein the measurement beam is directed substantially perpendicularly onto mirror 31b.

With regard to claim 2, Ukaji teaches a method of determining the displacement of an object in an apparatus along the z-direction, said object having a surface which extends substantially in a plane perpendicular to said z-direction and which is illuminated by a beam of radiation having an optical axis extending along the z-direction, said method comprising(Fig. 2):

providing an interferometer system comprising(Fig. 2; 33d):

a laser beam generator system configured to generate at least one reference laser beam and at least one measuring laser beam(column 6, lines 45-57);

at least one mirror, wherein said at least one mirror includes a measuring mirror with a fixed position relative to said object and having a mirror surface in which a reference line normal to the mirror surface makes a non-zero acute angle with said z-direction(Fig. 3, 31b);

an interference signal processing system configured to receive an interference signal produced by said reference laser beam and said measuring laser beam, and to determine said displacement based on a change in said interference signal(Fig. 2, 30);

providing said reference laser beam and said measuring laser beam such that said measuring laser beam is directed towards said measuring mirror to said mirror surface and said measuring laser beam is reflected by said measuring mirror to at least partly overlap said reference beam to generate said interference signal(column 6, lines 45-57);

determining a change in said interference signal(column 6, line 58- column 7, line 4); and

processing said change in order to determine the displacement of said object along the z-direction(column 6, line 58- column 7, line 4).

Ukaji uses a combination of mirrors 31b and 35 in the measurement path, and fails to teach wherein the measurement beam is directed substantially perpendicularly onto mirror 31b.

As to claim 3/2, wherein said measuring mirror is arranged such that said normal to said measuring mirror contains an angle α with respect to the z-direction, wherein α is between approximately 60° and about 87° (Fig. 3; column 7, lines 5-8). The angle 2θ is defined as the angle between the incident beam and the line normal to the mirror 35 which has a range of: $0^\circ < 2\theta < 90^\circ$. Because the angle of incidence is equal to the angle of reflection, the angle between the incident beam and the line normal to the mirror 31b is θ . Basic geometry defines the angle between the Z-axis and the line normal to the mirror 31b as $90^\circ - \theta$ which is applicant's angle α . Therefore, as 2θ approaches 0° angle α will approach 90° . This will include the range of 60° to 87° .

As to claim 4/2, wherein said measuring mirror is arranged such that said normal to said measuring mirror contains an angle α with respect to the z-direction, wherein α is between approximately 75° and 85° (Fig. 3; column 7, lines 5-8). See the rejection of claim 3.

As to claim 5/2, Ukaji fails to teach wherein said measuring laser beam is directed such that a distance between a point where said optical axis of the beam of radiation intersects said surface of said object and a line coincident with an optical

axis of a part of said measuring laser beam that is incident on said measuring mirror is less than 6 mm.

As to claim 6/2, wherein at least one additional displacement is determined and said interference signal processing system uses said additional displacement to determining the displacement of said object in the z-direction(column 6, line 58-column 7, line 4).

With regard to claim 8, Ukaji teaches a lithographic apparatus (Fig. 6), comprising:

- a projection system configured to provide a beam of radiation for illuminating an object(Fig. 6, 1-3), said beam of radiation having an optical axis in a z-direction;

- a movable holder configured to hold said object(Fig. 3, 21); and

- an interferometer system configured to determine a displacement of said object along a z-direction(Fig. 3, 33d), said interferometer system comprising:

 - a laser beam generator system configured to generate at least one reference laser beam and at least one measuring laser beam(column 6, lines 45-57);

 - at least one mirror, wherein said at least one mirror includes a measuring mirror with a fixed position relative to said object and having a mirror surface in which a reference line normal to the mirror surface makes a non-zero acute angle with said z-direction(Fig. 3, 31b); and

an interference signal processing system configured to receive an interference pattern based on said reference laser beam and said measuring laser beam and to determine said displacement based on a change in said interference signal(Fig. 3, 30).

Ukaji uses a combination of mirrors 31b and 35 in the measurement path, and fails to teach wherein the measurement beam is directed substantially perpendicularly onto mirror 31b.

As to claim 9/8, further comprising a holder mover system configured to move said holder, wherein said holder mover system is operatively connected to said interferometer system(column 10, lines 13-16).

As to claim 10/9, wherein said holder mover system is at least controlled by said interferometer system when moving said holder along the z-direction(column 10, lines 13-36).

As to claim 11/8, wherein said measuring mirror is arranged such that a normal to said measuring mirror contains an angle α with respect to the z-direction, wherein α is between approximately 60° and about 87° (Fig. 3; column 7, lines 5-8). See the rejection of claim 3.

As to claim 12/11, wherein said measuring mirror is arranged such that a normal to said measuring mirror contains an angle α with respect to the z-direction, wherein α is between approximately 75° and 85° (Fig. 3; column 7, lines 5-8). See the rejection of claim 3.

As to claim 13/8, Ukaji fails to teach wherein said measuring laser beam has a direction such that a distance between a point where the optical axis of said beam of radiation intersects said surface of said object and a line coincident with an optical axis of a part of said measuring laser beam that is incident on said measuring mirror is less than 6 mm.

As to claim 14/8, further comprising an additional displacement measuring system configured to determine at least one additional displacement in at least one additional direction, wherein said interference signal processing system has been arranged and constructed to use said additional displacement in determining the displacement of said object in the z-direction(Fig. 2, 33a; column 6, line 58- column 7, line 4).

As to claim 15/8, wherein said interferometer system is configured to determine at least one additional displacement, wherein said interference signal processing system is constructed and arranged to convert a combination of said interference signal and said at least one additional displacement into a value for the z-displacement(Fig. 2, 33a; column 6, line 58- column 7, line 4).

With regard to claim 21, Ukaji teaches a device manufacturing method(Fig's 2,3,6), comprising:

providing an object in a movable holder(column 5, lines 1-20);

illuminating said object with a beam of radiation having an optical axis in the z-direction(column 8, lines 39-43);

moving said object during at least part of the illuminating(column 10, lines 10-16); and

determining a displacement of said object along the z-direction(column 6, line 58- column 7, line 4) by:

providing a reference laser beam(column 6, lines 45-57);

providing a measuring laser beam that is incident on a measuring mirror with a fixed position relative to said object such that a reference line normal to the measuring mirror makes a non-zero acute angle with said z-direction, said measuring laser beam being reflected and at least partly overlapping said reference beam to provide an interference signal(column 6, lines 45-57);

determining a change in said interference signal(column 6, line 58- column 7, line 4); and

processing said change in order to determine the displacement of said object along the z-direction(column 6, line 58- column 7, line 4).

Ukaji uses a combination of mirrors 31b and 35 in the measurement path, and fails to teach wherein the measurement beam is directed substantially perpendicularly onto mirror 31b.

With regard to claim 23, Ukaji teaches a device manufacturing method(Fig's 2,3,6), comprising

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providing a projection system configured to provide a beam of radiation for illuminating an object, said beam of radiation having an optical axis in a z-direction(column 8, lines 39-43);

providing a movable holder configured to hold said object(column 5, lines 1-20);

providing an interferometer system configured to determine a displacement of said object along a z-direction, said interferometer system comprising(column 6, lines 45-57):

a laser beam generator system configured to generate at least one reference laser beam and at least one measuring laser beam(column 6, lines 45-57);

at least one mirror, wherein said at least one mirror includes a measuring mirror with a fixed position relative to said object and having a mirror surface in which a reference line normal to the mirror surface makes a non-zero acute angle with said z-direction(column 6, lines 45-57); and

an interference signal processing system configured to receive an interference pattern based on said reference laser beam and said measuring laser beam and to determine said displacement based on a change in said interference signal(column 6, line 58- column 7, line 4);

securing an object in said holder(column 9, lines 13-15);

illuminating said object with said beam of radiation(column 10, lines 10-24);
and

moving said object during at least part of said illuminating(column 10, lines 10-16);

wherein the z-displacement of said object is determined based on said interferometer system and said interference signal processing system of said lithographic apparatus(column 6, line 58- column 7, line 4).

Ukaji uses a combination of mirrors 31b and 35 in the measurement path, and fails to teach wherein the measurement beam is directed substantially perpendicularly onto mirror 31b.

Peggs et al teach mounting a measurement mirror on an object to measure displacement along the Z-axis, a line normal to the measurement mirror having a non-zero acute with the Z-axis; and perpendicularly directing the measurement beam from an interferometer on the measurement mirror, see figure 1.

With regard to claims 1, 2, 8, 21, and 23; it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ukaji by replacing the Z-axis measurement interferometer 33d and mirror 35 with an interferometer in which the measurement beam is incident perpendicularly on the mirror 35.

The motivation for this modification is shown in Peggs et al, figure 1. With this configuration the number of parts in the system is reduced, mirror 35 is

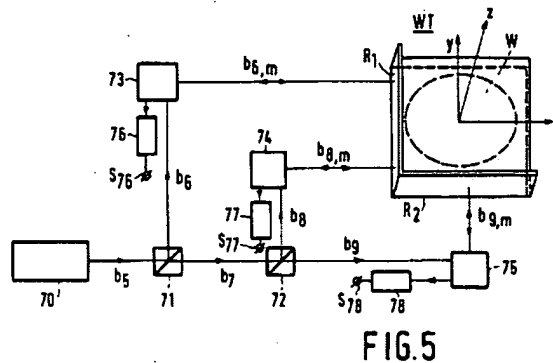
eliminated. Claims 3, 4, 6, 9-12, 14, and 15 are dependent from claims 1, 2, or 8 and therefor are also included in the rejection.

With regard to claims 5 and 13; because the incident measurement beam is now perpendicular to mirror 31b, and the angle θ of mirror has an angle of $45^\circ \leq \theta < 90^\circ$ (column 10, lines 24-30), the point of intersection between the optical axis of the measuring laser beam and the optical axis of the beam of radiation will vary along the optical axis of the beam of radiation. Thus, the value of θ and the range between the intersection point and the wafer surface are variable. It has been held that where the general conditions of a claim are disclosed in the prior art both the discovering an optimum value of a result effective variable (*In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980)) and discovering the optimum or workable range (*In re Aller*, 105 USPQ 233) involves only routine skill in the art. Therefor, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ukaji/Peggs such that the optical axis of the measuring laser beam intersects the optical axis of the beam of radiation at a point less than 6mm from the point where the optical axis of the beam of radiation is incident on the surface of the object.

The motivation for this modification is found in Ukaji in that the angle θ has a range of $45^\circ \leq \theta < 90^\circ$. Basic geometry thus defines the points of intersection between optical axis of the measuring laser beam, the optical axis of the beam of radiation, and the wafer surface.

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Claims 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ukaji(6,285,457) in view of Peggs et al(CIRP-1999) as applied to claims 1-6, 8-15, 21, and 23 above, and further in view of Van Den Brink(5,801,832).



As to claim 16/8, Ukaji teaches that “the laser interferometers described have a well-known structure”(column 6, lines 12-18), but fails to teach wherein said laser beam generator system is capable of providing at least one additional measuring laser beam and at least one additional reference laser beam for determining at least one additional displacement of said holder.

As to claim 17/16, Ukaji fails to teach wherein said measuring laser beam and at least one additional measuring laser beam are substantially parallel and incident on said measuring mirror.

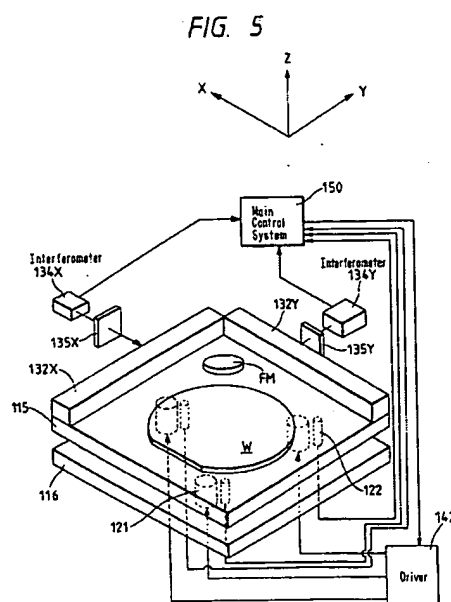
Van Den Brink teaches that all the interferometers in a lithographic projection system can share a common source(Fig. 5, 70).

With regard to claim 16, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ukaji by providing a single laser source for interferometers 33a-33d, 34a, and 34b.

The motivation for this modification, as taught by Van Den Brink, is a reduction in the number of laser sources for each interferometer.

With regard to claim 17, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ulaji with the specific laser interferometer of Peggs et al. The laser interferometer of figure 2 in Peggs et al is a known heterodyne interferometer from Zygo. It provides a first measuring beam f2 which measures linear displacement when interfered with reference beam f1. A second parallel measurement beam, now f1, is incident on the measurement mirror and a measurement of angular displacement is obtained when beams f1 and f2 are again interfered.

Claims 22 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ukaji(6,285,457) in view of Peggs et al(CIRP-1999) as applied to claims 1-6, 8-15, 21, and 23 above, and further in view of Yamasaki et al(6,122,036).



As to claims 22/21 and 24/23, Ukaji fails to teach wherein, during at least a part of the illuminating of said object, the optical axis of said beam of radiation is outside said object in said holder.

Yamasaki et al teach an alignment mark(Fig. 5, FM) located on the stage and separate from the wafer is used to determine Abbe error for the interferometer system when the optical axis of said beam of radiation is at the image position of the alignment mark(column 15, line 58- column 16, line 19).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ukaji with an additional alignment mark directly on the stage and not on the wafer.

The motivation for this modification is found in Yamasaki et al which teaches this arrangement to measure the Abbe error.

Relevant Prior Art

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Castenmiller et al(6,875,992), see figure 3; Van Doren et al(6,876,453), see figures 2A and 4 ; and Schluchter(7,158,236), see figures 2-7A.

Allowable Subject Matter

Claim 20 is allowed in view of the prior art of record.

The prior art of record fails to teach the limitation of "the measuring laser beam has a direction of incidence on the measuring mirror outside a plane in which the z-direction and said normal to said mirror surface lie, there being provided a

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separate mirror constructed and arranged for substantially retro-reflecting said measuring laser beam" in combination with the remaining limitations of claim 20.

The allowable status of claims 18 and 19 cannot be determined at this time, see the rejection of claims 18 and 19 under 35 U.S.C. § 112, first paragraph, above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Samuel A. Turner whose phone number is 571-272-2432.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley, Jr., can be reached on 571-272-2800 ext. 77.

The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Samuel A. Turner
Primary Examiner
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